

AODV ROUTING PROTOCOL MODIFICATION WITH STACK FOR VANET IN CITY SCENARIOS

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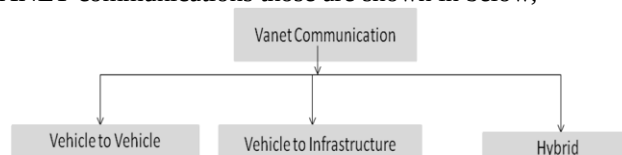
Abstract— Vehicular ad hoc network (VANET) is the sub part of mobile ad hoc network (MANET). It provides Intelligent Transport System i.e., provides wireless communication among vehicles and vehicle to roadside equipments. Based on this communication road network classified into two types 1) vehicle to vehicle communication, 2) vehicle to infrastructure communication. According to today's traffic condition VANET technique is very useful technique for achieving safe and secure transport system. For introducing this technique, there are several types of routing protocols are developed. But all these routing protocol does not work efficiently in VANET.

In this paper, we proposed a modified AODV routing protocol with the help of stack introduction into the RREQ header. It is based on packet delivery, packet drop and throughput. It shows less information of packet transmission compare to original AODV. Hence our proposal has less overhead routing algorithm compared to original AODV.

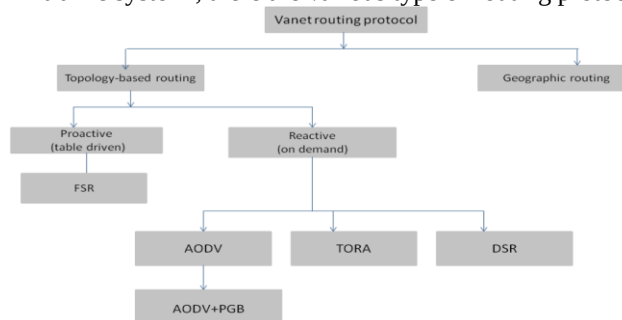
Key words —VANET, stack, AODV, NCTUns-6.0

I. INTRODUCTION

In today's world the traffic system is very much complicated because a huge congestion due to heavy vehicle and human beings. For giving them secure and safety traffic control system, VANET technology is introduced. There are three types of VANET communications those are shown in below,



VANET is the one kind of Mobile Ad-hoc Network (MANET) but it is autonomous and self organizing wireless communication network. For creating autonomous wireless communication, among vehicles on the road for the help of traffic condition, safety, unique identity of every vehicle etc. For this autonomous wireless, every vehicle act as a node and involve themselves as a server or client for delivering information among themselves. For implementing VANET in traffic system, there are various type of routing protocol developed.



Proactive routing protocol: In proactive routing protocol, routing information i.e., next hop forwarding technique is maintained by back ground irrespective of communication request. As this routing information scheduled by routing table, so there is no need to route discovery process. It is the advantage of proactive routing protocol and the great disadvantage is that it provides low latency in real life application. The various type of proactive routing protocols are FSR, DSDV, OLSR.

Reactive routing protocol: In Reactive routing protocol, routing information i.e., next hop forwarding techniques handle dynamically. When it necessary to communicate with other nodes then it needs to create route discovery by broadcasting a message and this process continues until the destination is found. The various types of reactive routing protocols are AODV, DSR, and TORA.

AODV

Ad hoc On-demand Distance Vector (AODV) routing protocol is one of the important routing protocol used in VANET system. It is known that AODV is a reactive routing protocol which is based on topology based routing protocol. This AODV routing algorithm enables dynamic, self starting, multi-hop routing between participating mobile nodes wishing to establish and maintain an ad-hoc network [1]. As AODV routing algorithm is dynamic so it also allows highly mobile nodes to create a routes very fast for getting new destination, and the nodes which are not connected is not necessary to maintain the routes. As AODV used in VANET system ,so it allows the nodes to break a linkage from a network and can join this node to another network. But during packet delivery time AODV does not allows the loop(closed path) and the shortest path is measured by Bellman-Ford “counting to infinity problem”

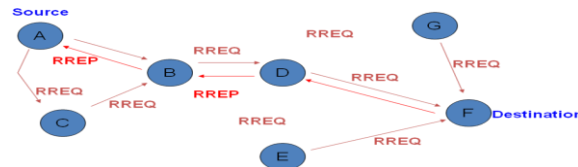


Fig:1 AODV working mechanism

AODV CONTROL MESSAGES

AODV routing protocol defines three types of control messages for discovering and maintaining the routes, those are Route Request(RREQ) , Route Reply(RREP) and Route Error(RREP) packets[2].

RREQ: The first operation of AODV is route discovery process for delivering packet from source to destination. For that source node broadcast RREQ message to its all neighbor nodes and those nodes again broadcasts the same packet to its neighbors. This process is continued until the destination node is found. The RREQ packet format[1] shown in below,

0	1	2	3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1			
	Type	J R G D U	Reserved
	RREQ ID		
	Destination IP Address		
	Destination Sequence Number		
	Originator IP Address		
	Originator Sequence Number		
	Hop Count		

Fig 2: RREQ packet format

RREP: The node which is either destination node valid node to the destination unicast the RREP message to its adjacent previous node from which it got the RREQ message first. In this way source to destination path is created. This RREP packet format[1] shown in below,

0	1	2	3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1			
	Type	R A	Reserved
	Destination IP address		
	Destination Sequence Number		
	Originator IP address		
	Lifetime		

Fig3: RREP packet format

RRER: When any node detects a breakage in active route , then error message is generated. The node where the breakage occurs ,then this node send the RRER message to the next node in the way of destination.

0	1	2	3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1			
	Type	N	Reserved
	Unreachable Destination IP Address (1)		
	Unreachable Destination Sequence Number (1)		
	DestCount		

Fig4: RRER packet format

That node will take the ip address from the routing table and RREP message resend in the new way. The RRER packet format shown in above.

Throughput

Throughput is the average number of successfully delivered data packets on a communication network or network node. In other words throughput describes as the total number of received packets at the destination out of total transmitted packets [6]. Throughput is calculated in bytes/sec or data packets per second. The simulation result for throughput in NCTUns6.0 shows the total received packets at destination in KB/Sec, mathematically throughput is shown as follows:

$$\text{Throughput (kb/sec)} = \frac{\text{Total number of received packets at destination} * \text{packet size}}{\text{Total simulation time}} \text{---kb/sec}$$

II. RELATED WORK

Dharmendra Sutariya et. al[3] in 3012, proposed a routing protocol AODVLSR(AODV Limited Source Routing) that ensures giving timely and accurate information to drivers in V2V communication compare to AODV protocols in city scenarios of vehicular ad-hoc networks and AODV is defined as limited source routing up to two hops for network nodes. The performance of proposed AODVLSR protocol is compare with basic AODV protocol in terms of Packet Delivery Ratio , Avg. End-to-End delay, Dropped TCP packets and normalized routing load.

Annu Mor[4] in 2013, proposed cross layer technique that find channel security at link layer to AODV routing protocol to improved the communication in vehicles for safety.

Gulhane S.P. et. al[5] in 2012, proposed the vehicular ad-hoc networks and the typical routing protocol. The ad-hoc on demand routing protocol(AODV) in mobile ad-hoc networks and the optimized protocol AODV-OBd for protocol AODV.

Aswathy M C et. al [2] in 2012,proposed at improving the performance of AODV by enhancing the existing protocol by creating table clusters and perform coming by clusters nodes and gateway nodes.

Uma Nagaraj et. al[6] proposed the advantages/disadvantages and the applications of various routing protocols for vehicular ad-hoc networks. It explores the motivation behind the designed, and trace the evolution between routing protocols.

Uma Nagaraj et. al[7] in 2012 , proposed to compare four well-known protocols AODV,DSR,OSLR and DSDV by using three performance metrics packet delivery ratio, average end to end delay and routing overhead.

V.P.Patil [8] in 2012, proposed an innovative approach to deal with the problem of traffic congestion using the characteristics of vehicular ad-hoc networks. The system is developed and tested using AODV protocol of ad-hoc mobile network to deal with the problem of vehicle traffic congestions in vehicular ad-hoc networks. The performance is measured in terms of no. of packet broadcasted, percentage of packet delivery and percentage of packet diverted and overhead to manage the problem of data traffic congestion in computer networks.

Rakesh Kumar et. al [9] in 2011, an extended AODV routing protocol proposed for AODV networks which typically suits to resolve the realistic model problems. This propose protocol may improve the performance of regular AODV routing protocol. It has all features of AODV routing protocol, at is follows all the steps of the discovery algorithm of AODV routing protocol.

Neeraj Sharma et. al[10] in 2013 performed analysis the AODV and GPSR routing protocol used in VANET and concluded them.

III. PROPOSED WORK

Proposed modified AODV routing protocol by implementing a stack on the basis of packet collision, packet drop and in-out throughput. The fact is that when a intermediate node between source and destination gets some packet from the another node which had got from any other node will push the node's IP to the generated stack instead od discarded. During unicast the RREP packet if any link is breakage, then this node pop the another node from the created stack and re-unicast the RREP packet .

For implementing the modified AODV protocol the proposed algorithm is,

Algorithm of sAODV:

Step 1: Until destination is not found continue the broadcast procedure.

Step 2: If node n is the destination then

Step 2.1: Reply RREP packet.

Step 3: else

Step 3.1: If node (n-m) already received the packet,

Step 3.1.1: Push the packet into stack.

Step 3.2: else

Step3.2.1: The intermediate node rebroadcast the packet.

Step 4: Until source node get the RREP message, the destination and the intermediate node unicast the RREP packet.

- Step 4.1:** If any node does not get acknowledgement with in the time,
Step 4.1.1: Pop the element from the stack and update the sequence number and IP address the re-unicast RREP packet.
Step 4.2: else
Step 4.2.1: If the node is Source node then in can ready to send data packet.
Step 4.2.2: Otherwise unicast the RREP packet.

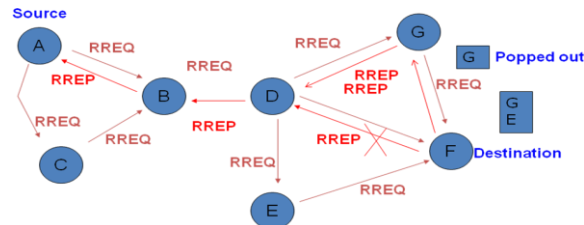


Fig5: on error

Complexity analysis:

As the conventional AODV followed the bellman-ford algorithm , so the complexity should be $O(VE)$ where V is the number of vertices and E is the number of edges. As we implementing a stack in this protocol so the complexity of sAODV will be $[O(VE)+O(V)] = O(V^2E)$] which is more than conventional AODV but the great advantage of this protocol is that , in unicasting RREP packet if the previous adjacent node does not exist it follows the another path choosing the previous node that is pop out from the stack and it will continue the communication between the sender and destination rather than destroy the graph.

IV.Simulation Result and analysis

In this study, we used NCTUns-6.0 for simulation. We have chosen this simulator because[12],

1. Highly integrated and professional GUI environment.
2. Support for various network protocols.
3. Support for various important network.
4. Same configuration and operations as for real life networks.
5. High simulation speed and repeatable simulation result.
6. High fidelity simulation results.

Simulation scenario:

We have taken a mess scenario(city scenario) as our proposed algorithm for routing based on AODV ,for dense traffic.

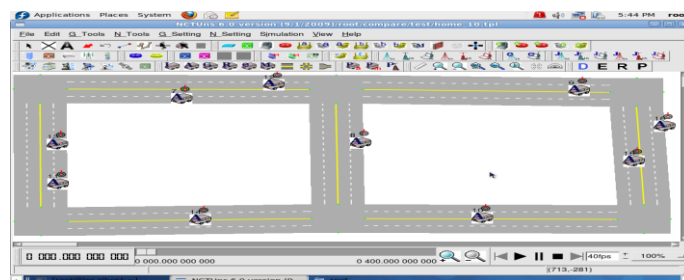


Fig 6: City Scenario Graph

Parameter	Settings
Transmission mode	TCP/IP
Lane Width	20m
Simulation time	100sec
RTS threshold	3000bytes
The car profile (Taken five)	18km/H, 36km/H, 50km/H, 60km/H, 80km/H
Number of lane	2
The protocol	AODV,sAODV
standard used for each vehicular node	IEEE802.11b
cars are selected for three different scenarios	5,10,15,20,25,30,35,40
Transmission power used	15dbm

Table: input parameter for testing scenario

V. Result

X-axis stands for time in sec and y-axis stands for throughput(kb/sec).

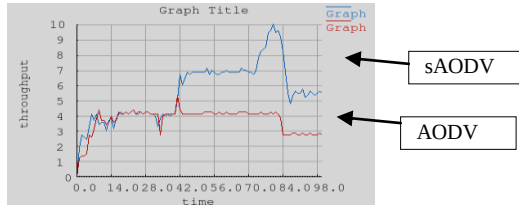


Fig 7: Throughput vs Time for 5 cars

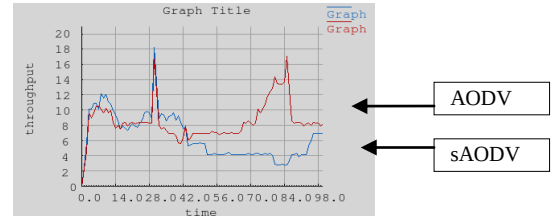


Fig 11: Throughput vs Time for 25 cars

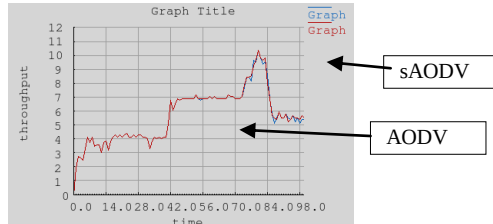


Fig 8: Throughput vs Time for 10 cars

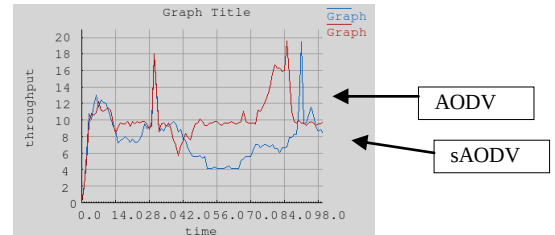


Fig 12: Throughput vs Time for 30 cars

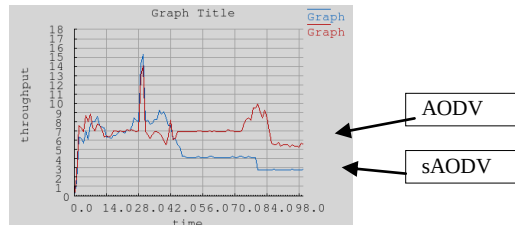


Fig 9: Throughput vs Time for 15 cars

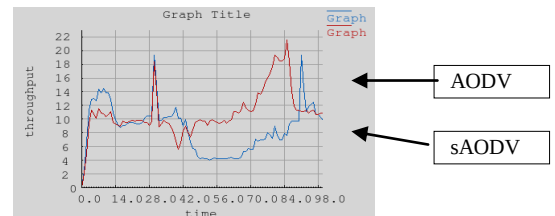


Fig 13: Throughput vs Time for 35 cars

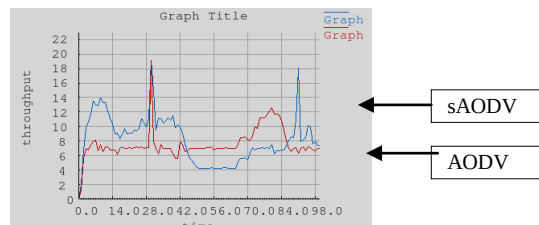


Fig 10: Throughput vs Time for 20 cars

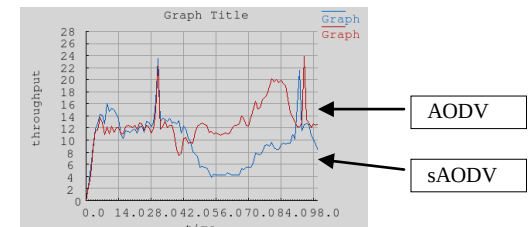


Fig 14: Throughput vs Time for 40 cars

VI. ANALYSIS

Here we found initially both protocol's throughput are almost same but after some time sAODV much better than original AODV. Here we have taken low car density (5) then packet loss will be much more therefore our stack utilization is better here.

Next when we increase our car density (10,15,20,25), we observe initially sAODV throughput is better than conventional AODV as initially packet loss is much more as synchronization is not done therefore our protocol works better. But as a progress original AODV works better compare to sAODV. Here packet loss is much less therefore stack utilization is less here. Therefore sAODV's throughput is less than original AODV's throughput.

Finally we found in fig(12,13,14), almost similar performance where average throughput of sAODV is less compare to original AODV. Hence it proves when we need not to utilize stack or failure of node is less, more number of packet transmitted by original AODV. Whereas sAODV need to send less number of packet to reply. Therefore we observe sAODV is better than conventional AODV with respect of number of packet transmission to complete routing.

VII. CONCLUSION AND FUTURE WORK

As we have proposed a backup path(stack) information for reply ,AODV protocol works better. Though sAODV takes more time but it has a great preference that is the graph cannot disconnect due to breakage of any link. So that the packet delivery is continuously going on several paths between source to destination.

Our future work is that we will modified this AODV protocol by using de-queue and compare with original AODV protocol as stack has much more time complex.

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